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AUTHOR Odom, Richard D.; And Others
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ABSTRACT

This paper presents a study which indicates that accurate performance on a simple conservation task need not be related to congnitive maturity. Twenty adults and 20 third graders were given three verbal problems, each requiring a same-different judgment and an explanation of that judgment. Only 3 adults were able to give correct judgments, while 19 of the children were able to do so. It was surmised that the adults were not able to ignore irrelevant information, and that carefree attention to the characteristics of task information is necessary if advances in developmental theory are to be realized. (ED)

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Adults Thinking The Way We Think Children Think, But Children Don't Think That Way

Richard D. Odom, Eileen C. Astor,
and Joseph C. Cunningham

Vanderbilt University

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The subjects in this study were given three verbally presented problems, each requiring a same-different judgment and an explanation of that judgment. Each problem began in the following way: "Imagine that I have two cans. One has red beads in it, and it is called the red-bead can. The other has blue beads in it and is called the blue-bead can. There are the same number of red beads in the red-bead can as there are blue beads in the blue-bead can. Let me repeat that. There are the same number of red beads in the red-bead can as there are blue beads in the blue-bead can. Now, imagine that I dip a cup into the red-bead can and take out five beads. I pour them into the blue-bead can." The remaining part of each problem made them distinctive.

In the Mix problem the experimenter said, "Then I mix up all the beads in the blue-bead can. I then dip the cup into the blue-bead can and take out five beads and pour them into the red-bead can. Will the number of red beads in the red-bead can and the number of blue beads in the blue-bead can be the same or different?"

In the No Mix problem the experimenter said, "I then dip the cup into the blue-bead can and take out the same five red beads and pour them into the red-bead can. Will the number of red beads in the red-bead can and the number of blue beads in the blue-bead can be the same or different?"

In the Mix-1 Less problem the experimenter said, "Then, I mix up all the beads in the blue-bead can. I then dip the cup into the blue-bead can and take out only four beads and pour them into the red-bead can. Will the number of red beads in the red-bead can and the number of blue beads in the blue-bead can be the same or different?"

Performance on the Mix problem was of major interest. The task is a conservation-type problem, and a friend who studied with Piaget for three years described it as a double-conservation problem. A few years ago Frank Murray presented the task to an audience of Ph. D.'s and graduate students at Vanderbilt and no one was willing to hazard a guess even though the problem had been presented toward the end of a series of conservation problems. Since that time we have informally observed that many adults respond incorrectly to the problem.

The correct answer to the question at the end of the problem is "same," and an acceptable explanation can involve adding and subtracting operations with specific numbers or something like "the number of red beads left in the blue-bead can equals the number of blue beads taken to the red-bead can."

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Subjects

The subjects were 20 Vanderbilt adults selected from an Introductory Psychology course and 20 third-grade children selected from a private school in Nashville. The problems were presented to each child individually and to groups of adults.

Rationale

We surmised that a failure to respond correctly to this problem was due primarily to the cognitive evaluation of the information about the mixing of beads, which is irrelevant to solving the problem. Giving as much or more cognitive priority to the irrelevant as to the relevant information, which concerned the color and number of beads, was considered to be due to the compellingness or salience of the irrelevant information. (See Odom, 1972; Odom & Corbin, 1973; Odom & Guzman, 1972 for a discussion of perceptual salience and its effects on problem solving.) It was further suspected that this particular irrelevant information would not be highly salient for young children and that they would solve the problem by cognitively evaluating the relevant information only. Before beginning the study it was established that the children had not received classroom instruction in statistics or probability theory.

The No Mix and Mix-1 Less problems were given primarily to assess the reliability of judgments. All subjects were expected to give a "same" judgment to the No Mix problem and a judgment of "different" to the Mix-1 Less problem.

Results

The results were in accord with expectations. Only 3 of the 20 adults gave correct "same" judgments to the Mix problem, while only 1 of the 20 children gave an incorrect judgment of "different." All of the subjects correctly answered both the No Mix and Mix-1 Less problems.

Of the adults' written explanations for the incorrect judgments in the Mix problem, 14 of the 20 contained probability accounts involving the mixing operation. In 11 of those 14 there was a recognition that it was possible, but not probable, that all red beads could be drawn from the blue-bead can and that this outcome would require a "same" judgment. It would seem that the latter would logically lead to a judgment of "same," but it didn't.

None of the three adults who gave "same" judgments gave a satisfactory explanation. Of the adults incorrectly responding with "different," only one corrected his judgment and gave a satisfactory explanation.

The 19 children who gave a correct judgment also demonstrated adding and subtracting operations necessary for a satisfactory explanation when the experimenter took them through the steps of the Mix problem after arbitrarily starting the problem with six beads in each can. The one child who gave an incorrect judgment changed it and gave a satisfactory explanation. The mixing operation was clearly unimportant and none of the children mentioned it in their explanations.

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After explanations were given, the experimenter probed the last 13 children for a concept of probability. This was done by posing a situation in which many samples of 5 beads were dipped from the blue-bead can after the red beads had been mixed with the blue beads and asking whether there would be more cups with all red or all blue or whether there would be more with red and blue together. Eleven (85%) of the 13 gave the latter choice.

Conclusions

The children in the present study were shown to have cognitive operations and structures necessary for evaluating and analyzing information that was both relevant and irrelevant for problem solution. However, the irrelevant information was apparently so low in salience that it played no important role in determining their correct judgments. For the adults, on the other hand, it appeared to be quite salient and resulted in incorrect judgments.

Age-related differences in the salience of given information are assumed to be due in large part to the number of past situations that provide experiences with that information. Because amount of exposure to information of all sorts is almost always positively correlated with age, younger subjects may be relatively less accurate in most problem-solving tasks used in developmental research because they may be cognitively evaluating highly salient, but irrelevant information for problem solution. Their inaccuracy may not be primarily due to less developed cognitive structures and operations that analyze and evaluate information but to perceptual characteristics, like salience, of that information. Only in rare situations, such as the Mix problem of the present study, are younger subjects more accurate than older subjects. In such cases, however, it is doubtful that cognitive-change theorists, who give little or no attention to the role of perceptual development and to age-related differences in what information is cognitively processed, would be willing to conclude that, because of the older subject's greater inaccuracy, he is less cognitively mature than the younger subject. Careful attention to the characteristics of task information will be necessary if advances in developmental theory are to be realized.

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